An Australian science communication case study based on recovery of the endangered fish red-finned blue-eye, *Scaturiginichthys vermeilipinnis*

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Despite the accepted need for better communication of science and research to non-scientific audiences, peer reviewed papers remain the most common – and frequently the only – method by which research results are communicated. Continuation of this practice in isolation is unlikely to present the results to a wider audience because the majority of non-scientific readers do not consult scientific journals. In this case study the methods used to promote a project concerning the conservation of a small endangered fish from the Australian semi-arid zone are discussed and recommendations are made regarding using such methods more widely. The problem of evaluating such strategies is alluded to, as this is most-often a subjective exercise, and as such difficult to quantify using traditional measurement methods. Results from a small survey of journalists and educators are also presented in order to demonstrate the most important features a science story needs in order to be communicated successfully to a general audience. The case study demonstrates that harnessing a range of communication media (radio, television, internet, magazines, books, public speaking and formal papers) combined with a spatial approach (local, regional, national and international) is a sensible way to garner support and encourage interest in what are often esoteric and obscure research endeavours.

KEYWORDS: science communication, Edgbaston, Great Artesian Basin springs, Lake Eyre Basin

INTRODUCTION

There is a recognised need for scientists to engage with and communicate their work to the general public (Hobbs & Wills 1998; Jacobson 1999; Jacobson *et al.* 2006), and this is especially so when research is conducted using public funding (Wolfendale Committee 1995). Although recent trends such as public access policies (of both governments and granting institutions) and an increase in Open Access publishing mean that there is now improved access to scientific papers (Harnad *et al.* 2004, 2008), the challenge remains the engagement of people who do not consult such literature.

Work relating to how best to engage the public usually identifies barriers, such as a lack of communication skills, and solutions, such as increasing the school/university interface and personifying science using 'heroes' and examples from popular culture (Winter 2004). Work relating to the factors that motivate scientists to undertake such engagement (or not) are less predictable (Poliakoff & Webb 2007). However, it is important to note that there is reticence on the part of practitioners to actively engage. A study of almost 1500 scientists demonstrated that 64% believed their time was more appropriately spent on research, and – perhaps more importantly – 20% believed that engagement with lay people would result in a diminution of their reputation amongst peers (Royal Society 2006).

Given the vast array of media and communication options that are potentially available, it is also likely that in many instances scientists and/or their employing institutions may be overwhelmed by the very concept of attempting to determine which communication method or medium is most appropriate or accessible, and fearful that the risk of inaccurate reportage of research is a greater threat to their careers than the obscurity that results from non-engagement.

This case study is Australian and relates to the communication of an ecological project – as such the vast majority of sources are active participants within the fields of journalism and education rather than science. The immediate and obvious difference to traditional science is exemplified by this fact alone, for the reference list is dominated not by peer-reviewed papers but by radio, newspaper and internet articles. The need to accept such work as 'valid' or at least acceptable by scientists is fundamental to a better uptake of public engagement opportunities. However, evaluating the success of such public engagement endeavours is hampered by a lack of measurable indicators: in many instances the impact of a media story or education initiative can only be measured subjectively. Accepting this situation, or developing methods to evaluate initiatives such that they are recognized as part of what academics do, may be a necessary step in increasing participation.

Australia has several advantages as a country in which science communication – particularly biological science communication – could be better practiced, including a small, wealthy and technology savvy population, a single language, discrete borders and a unique assemblage of fauna and flora. However, few scientists are recognised by the general public outside their area of discipline. Notable exceptions include the paleontologist Professor Tim Flannery, well known as an author of natural history books and more recently as a spokesperson on climate science (Flannery 1994, 2005, 2012), the ecologist Professor Richard Kingsford, a vocal environmental spokesperson (Kingsford 2006) and the late Professor Peter Cullen, the founder of the Wentworth Group of Concerned Scientists. In all cases, the notoriety of these scientists outside academia has been facilitated

by active engagement of media and communication opportunities and a willingness to partake in political and public debate (despite the hostility – up to and including death threats – that this occasionally engenders, R. Kingsford pers. comm).

This paper details the science communication work that has extended from 2009 to the present (2014) relating to a project that is attempting to prevent a small endangered fish, the red-finned blue-eye, *Scaturiginichthys vermeilipinnis*, from becoming extinct. Where possible, metrics (such as estimated audience, website visitation and monetary gifts) are used to demonstrate the success of the initiative. Other more subjective measures are also presented when they have been inferred and appear to be relevant. The project itself is summarised in the first section, followed by a description of the local/regional, national and international exposure that has been attained through science communication activities. In a separate but related section, the results of a survey of media and education professionals are summarised in order to support the project results and provide direct evidence of the requirements of these professionals regarding science communication material. In the conclusion, an appraisal of the communication efforts at all scales and the survey results are synthesized in order to make meaningful recommendations for the continuance and uptake of similar initiatives in Australia and elsewhere.

THE STORY – communication activities 2009–2014

The endangered red-finned blue-eye is a small (3 cm total length (TL)) fish that is only known from a group of Great Artesian Basin springs in semi-arid central-western Queensland (Figure 1). The property – Edgbaston – was purchased by the not-for-profit conservation organisation Bush Heritage Australia in 2008 with a view to conserving the spring complex and preventing red-finned blue-eye going extinct. The greatest threat to red-finned blue-eye is the invasive species eastern gambusia, *Gambusia holbrooki*, which is also present in the spring complex. All historical and anecdotal records indicate that invasion of individual springs by eastern gambusia results in red-finned blue-eye extinction (Fairfax *et al.* 2007), and when the property was purchased red-finned blue-eye were present in only four springs (Kerezsy & Fensham 2013). Recovery work commenced in 2009 with a view to determine control methods for eastern gambusia and establish populations of red-finned blue-eye in new and eastern gambusia-safe areas. More recently this work has included the construction of barriers around springs in order to prevent re-colonisation of red-finned blue-eye habitat by eastern gambusia during flooding, and in the future the establishment of a captive population is also planned. Most science communication work documented in the following sections relates directly to the project as whole

Figure 1 The endangered red-finned blue-eye from Edgbaston Reserve in central-western Queensland (above), and its habitat, a Great Artesian Basin spring (below) Photographs: Adam Kerezsy.

or specific aspects within it, and associated research is well represented and documented in the academic literature (Fairfax *et al.* 2007; Fensham *et al.* 2011; Kerezsy & Fensham 2013).

Local and regional science communication activities

The location of Edgbaston in central-western Queensland has facilitated continued access to the regional radio station (ABC Western Queensland) in Longreach, a small town that is a recognised transport, agriculture and services hub, and similarly easy access to the local newspaper, *The Longreach Leader*. In both instances, personal acquaintance with content managers and editors has meant that gaining access to these media organisations is as simple as a phone call, email or chance meeting. Between 2009 and 2014, approximately 20 radio interviews went to air (many also as internet stories) and five articles appeared in the newspaper (e.g. Clarke 2010; Harris 2011; Arthur 2012). All were either directly related to the project or addressed associated themes such as flooding and river health. It was particularly advantageous to be present in Longreach on many occasions and conduct interviews *in situ* at the radio station rather than over the phone.

The great advantage of radio in an isolated rural area is that there is only one radio station and that many landholders listen to the radio daily when going about their business. ABC Western Queensland has a potential listening audience of 57 000 (Nicole Bond pers. comm.) and covers the western half of the state of Queensland. Although it is difficult to judge the actual listening audience, anecdotal information suggests it is considerable: whenever a radio interview went to air, many acquaintances would relay the fact, and across a vast area of the country. A second advantage of radio, especially in isolated areas, is that scientific research is rare, and news and current affairs timeslots are often content-poor; presenters therefore welcome the opportunity to discuss local research. The red-finned blue-eye story offered (and continues to offer) a third advantage (which much research does not) as it is an on-going story and there are therefore numerous opportunities to present up-dates (for example post-flooding, post-storms and post-dry periods). Over time, the majority of the presenters at ABC Western Queensland have come to know the story themselves (as, presumably, have many listeners) and frequently begin an interview with a phrase like "So, how are the little fish going now?" This level of familiarity is a big advantage and means that presentation of up-dates has become more akin to a normal conversation than a formal interview.

In addition to local radio and newspaper stories, local coverage of the project was also achieved through public speaking at two conferences in western Queensland, the first in 2007 at the small town of Windorah (Kerezsy 2007) and the second in Longreach (Kerezsy 2013a). These presentations were advantageous more from a science communication than a pure science perspective because in both cases the audience was comprised of a combination of people with an interest in local land and water management including graziers, indigenous groups and townspeople. The Longreach conference provided the additional benefit of a video and internet record of each presentation, and this 20 minute talk was viewed 80 times in the 12 months since it was first posted (Kerezsy 2013b). A similar initiative by Desert Channels Queensland, the regional catchment management group, has produced a web-based video project (*Lake Eyre Basin: People and Passion* 2013) that presents interviews with a range of people with interest and expertise in various aspects of the area. At least four of the interviews have either a direct or indirect link to the red-finned blue-eye project and the springs at Edgbaston (Kerezsy 2013c; Silcock 2013; Fensham 2013; Tischler 2013) and the combined number of views for these presentations is currently 776 (as of March 30, 2014).

An additional advantage of the ABC radio interviews is that they are often syndicated throughout the organisation (which is national), and many have been reproduced at state (Queensland) and national level. Other media stories that reached a Queensland audience include several news stories in the daily newspaper *The Courier Mail* (Williams 2012; Edmistone 2012), a profile piece in *Q Magazine* (Bruce 2012) and a television current affairs segment that appeared on ABC television's *7.30* program (McLeish 2011a). Given the *Courier Mail's* circulation of 216, 638, the fact that *Q Magazine* is included in the Saturday edition and the nationwide reach of ABC television, it is likely that these pieces provided good statewide coverage of the project. It is noteworthy that in the vast majority of cases the thematic material in all media stories was very similar: a small and unusual fish, in a harsh and arid environment, with an enemy (eastern gambusia) and the efforts that were/are going towards saving it. Although science and experiments were/are occasionally mentioned, they have never been the focus of the reports.

In summary, the red-finned blue-eye project has received a substantial amount of media coverage at local, regional and state level. Any scientist conducting research in isolated or country areas of Australia could follow this example, and – most importantly – involve local people in their research through regular appearances on regional radio.

National science communication activities

There is a substantial difference between local/regional and even state communication activities and those at a national scale, and this is predominantly because the audience, though potentially much larger, can be assumed to have little idea of the context of the research (nor of the geography, climate and conditions in western Queensland in this particular case). This means that the story and main messages require further simplification and that there is usually a logistical component to the story (such as transporting and maintaining journalists in remote locations for several days). A potential advantage of this effort is that very often aspects of the transportation or maintenance can become part of the story themselves, and add to, rather than detract from, the central messages. A good example is the feature story that appeared in *Good Weekend* magazine (Bearup 2011), as wet conditions meant that the slightly dangerous drive out of the property was featured in the piece as well as the red-finned blue-eye story itself.

National news stories regarding red-finned blue-eye at Edgbaston have appeared in *The Age* (Smith 2012, circulation 197,500) and syndicated Fairfax newspapers (most notably the *Sydney Morning Herald*, circulation 207,013), on ABC Radio National and on the ABC's rural television flagship *Landline* (McLeish 2011b). The increasing trend of posting all stories on the internet (as well as in print media) is likely to mean that these figures are an underestimation of total audience reach. Additionally, many short news stories are often rendered in more detail as internet pieces: this was definitely the case with *The Age* story mentioned above, as the internet version included more photographs and a video interview. Given that this practice is likely to continue (Angela Wylie, Fairfax media, pers. comm.), it suggests that there may be multiple benefits of going to the trouble of transporting and maintaining journalists in remote areas for several days: the longer they are there, the more material they return with.

The benefit in terms of exposure of the project and attracting potential donors and supporters to Bush Heritage Australia (BHA) is difficult to judge in entirety but the metrics that are available are instructive (all following data courtesy of Bush Heritage Australia). Following publication of the *Good Weekend* feature article, unique visits to the BHA website increased by 300%, the number of pages visited doubled and an instant donation of $5000 was received. The equivalent value of the piece in terms of advertising space is estimated at $200 000. Following the airing of the story on *Landline*, three direct bequests were received by the company and website visitation increased to a similar degree. There was a 100% increase in website visitation following the news story published in *The Age*, where the equivalent advertising space rate is estimated to be $40 000.

Special interest magazines represent a different readership, often with prior knowledge of environmental

Figure 2 The full-page composite photograph that was used in the Good Weekend feature article (Bearup 2011; photography by Tim Bauer/Adam Kerezsy/*Good Weekend*).

and science issues but – again – limited knowledge of the project, the species or the area of interest. Their great advantage is that production values often result in the publishing of high quality images that can help to tell the story. The red-finned blue-eye story has been featured in magazines such as *Australian Geographic* (Pickrell 2012, circulation 82,339) and *Wildlife Australia* (Starbridge 2011). Like the more general news agencies, these magazines also present selected stories on the internet.

The success or failure of a feature article (in particular) often rests on the quality of the photographs rather than the story itself, and old adages (a picture tells a thousand words) appear to remain very applicable to modern media (Tim Bauer (freelance photographer), Angela Wylie (Fairfax photographer), Dean Caton (ABC cameraman), pers. comms.). The full-page picture that accompanied the *Good Weekend* feature is a good example: it encapsulated the Edgbaston story in one image by combining the fish, the landscape and the researcher (Fig. 2). This is especially significant given the readership of the magazine is 486,899 as it is an insert in both *The Age* and *The Sydney Morning Herald* – the largest newspapers in Australia's largest cities, Melbourne and Sydney, respectively – every Saturday.

The exponential growth of web-based media represents another way of publicising research, though the plethora of small sites and blogs can be difficult to negotiate. Red-finned blue-eye (and associated) pieces have been requested and published by sites such as *Realdirt.com* and *beforeitsgone.com* – both have a focus on environmental and/or wildlife related themes. A more high profile website with a science-focus is *The Conversation*, and profiles of both red-finned blue-eye and another endangered fish species, Edgbaston goby, *Chlamydogobius squamigenus*, have been published on this site as part of an on-going series concerned with Australia's endangered species (Kerezsy 2013d).

Gaining attention from non-science audiences can also be achieved by scientists publishing their work in different formats (ie: as opposed to peer-reviewed scientific literature). The natural history book *Desert Fishing Lessons* (Kerezsy 2011) is a relevant example, though there are many others (Johnson 2006; Pepperell 2010). Though not specifically concerned with the red-finned blue-eye story, the book touches on it, but perhaps more crucially enabled national coverage through a range of print media (particularly reviews) and an hour-long radio interview on the ABC's *Conversation Hour* program (Dalton 2011). An interview of this length is unprecedented in most other forms of media in Australia and represents a unique vehicle for communicating research to a very wide audience. More specific – and far more politically-aligned – is the periodical *Quarterly Review*. Being invited to respond or contribute to such a publication (Flannery 2012; Kerezsy 2013e), presents different opportunities: in this case to discuss political aspects of the Edgbaston story, most particularly the weaknesses of the existing regulatory framework concerning endangered species management in Australia.

Last, a substantial amount of public speaking also characterised the national communication events from 2009–2014. A total of 26 conference and similar presentations occurred, and although the majority were to science audiences at conferences such as Australian Society for Fish Biology, Australian Society for Limnology, Ecological Society of Australia and the Australasian Wildlife Management Society (e.g. Kerezsy 2009; 2010), notable exceptions included presentations to fish hobbyists through the Australia and New Guinea Fish Association (ANGFA), to a variety of community organisations and school groups and to a general audience at the Wheeler Centre in Melbourne, a talk that is also published online (Kerezsy 2012a).

A national approach to science and research communication does not have the intimacy of local and regional work, but this is balanced by the far higher potential audience and the flow-on effects that can occur. Communicating at this level is vital if organisations with a national reach (such as Bush Heritage Australia) wish to engage the general public in the conservation work they are undertaking and, by association, attract more donors and active supporters. Feature articles in weekend newspaper magazines are a traditional and obvious goal if such coverage is desired, however this may change as print media increasingly turns to online delivery of content.

International science communication activities

The rationale for making an effort to communicate aspects of the red-finned blue-eye project outside the academic literature stems from interest from international aquarists and fisheries ecologists in the papers that have been published thus far, combined with the demonstrated ease with which the species and the story effectively 'sells itself'. To be accurate, however, coincidence and opportunism could equally be appropriated: once a story such as this is available worldwide via the internet the material is effectively already 'international', and extra opportunities can be selected on merit.

The fish and its story has certainly been featured in German literature (Godlinski 2014), and interviews granted in an effort to convey the story as truthfully as possible across the language divide. However, the most high-profile international exposure that the project has received to-date has been inclusion in the IUCN's Breaking Point initiative, which aimed to highlight the plight of the 100 most endangered species worldwide (Kerezsy 2012b).

Although communication of most local research at international level is probably not necessary, desirable or possible, in instances where the subject has international appeal it should be considered, because even if the international exposure does not generate further international support or interest, its very existence is likely to elevate the profile of the work locally and nationally. In the case of the red-finned blue-eye, being listed as one of the most endangered species in the world (along with high profile terrestrial animals like the Javan and Sumatran rhinoceros) has elevated the status of a small colourful desert fish to a flagship species for the springs in which it lives, the harsh-yet-fragile Australian interior and the organisation that is sponsoring its recovery.

Table 1 Participants in the survey of media professionals who provided responses to the questions.

Name	Position/occupation and location
John Pickrell	Editor, *Australian Geographic* magazine, Sydney, NSW
Alun Hoggett	Digital Productions Consultant, Desert Channels Productions, Longreach, Qld
Terri-Ann White	Director, University of Western Australia Publishing, Perth, WA
Darren Shepherd	Principal, Toohey Forest Environmental Education Centre, Brisbane, Qld
Nicole Bond	Regional Contact Manager, ABC Western Queensland, Longreach, Qld
James Whitmore	Deputy Section Editor, Environment + Energy, *The Conversation*, Sydney, NSW
Kathy McLeish	ABC journalist, *7.30 Qld* and *Landline*, Brisbane, Qld
Brian Williams	Environment reporter, *Courier Mail* newspaper, Brisbane, Qld
Michelle Ransom-Hughes	Producer, *Conversations with Richard Fidler*, ABC, Brisbane, Qld
Chris Feik	Editor, Black Inc. books, Melbourne, Vic

THE SURVEY – what the media want

Three survey questions were emailed to a list of professionals working across a range of media (print, radio, television, magazine publishing, book publishing and internet) and at the same local/regional and national scales mentioned previously in the text (Table 1). The aim of the survey was encapsulated in the following questions and it was designed to allow participants to spend a minimum of time on the exercise (while still harvesting useful information):

1. What makes a science story easy or laborious?
2. What could researchers do better?
3. Any other large or small piece of advice that you think may be useful to scientists.

Responses to the survey were categorised based on the information that was returned (Fig. 3). The highest priority amongst all media professionals (70% of all responders) was the requirement for researchers to be able to make their work relevant to the everyday lives of potential audiences and to be able to enunciate why their research is important, and the second highest priority (60%) was the need to use simple language or prose and a minimum of scientific jargon. Two responders used the analogy of explaining research at a level that would be understandable by a grandparent (Nicole Bond, ABC, and John Pickrell, *Australian Geographic*). The ability to tell a story was identified by 30% of the responders as important to good science communication, and the need to imbue the story with either drama or humour and the inclusion of good visual material (either photographs or video) was important to 20% (Fig. 3).

Although the majority of responses to the questions had common themes and could be easily categorised (Fig. 3), some items of extra advice could not. Among these, one of the most useful is that scientists that demonstrably lack communication skills may be better off entrusting the communication of their work – no matter how interesting – to a third party such as a colleague or friend, the implication being that no matter how skilled or talented a scientist may be, some may not be able to master the communication skills required (Terri-Ann White, UWAP). Although this has similarities to the more formal concept of a science communicator or knowledge broker (Meyer 2010), it is more intimate and suggests that within a collegiate group of science professionals the individuals with the most advanced communication skills should – perhaps – be identified and permitted to represent the work of others in communication activities.

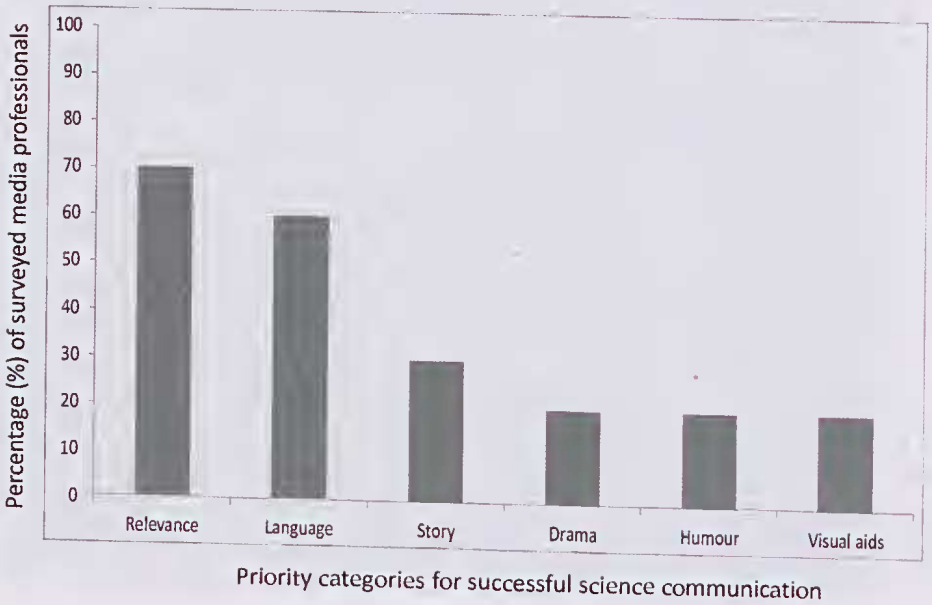

Figure 3 A graph showing priority categories identified by Australian media professionals for successful communication of scientific research projects to a wider audience.

CONCLUSION

The case study presented in this paper and the survey of media professionals who work in science communication are instructive in terms of planning and implementing science communication activities with the aim of raising the profile of a particular project or initiative. The red-finned blue-eye project at Edgbaston has several advantages when evaluated against the priorities of the media professionals. It has always been communicated with simple language, possibly because the initial communication activities (through ABC local radio) aimed to explain the project to a local and regional audience who, though familiar with the landscape, were not generally familiar with science or research. A great deal of effort went in to the 'relevance' aspect of this communication work, and the project was made relevant because a) the fish was endangered and close to extinction and b) the fish happened to inhabit an isolated and unusual part of Australia. In this way, local and regional people have come to have some ownership or interest in the project, despite not necessarily being intrinsically interested in fish or springs to begin with (Michael Wills (Barcaldine), David Coulton (Aramac), Jason Dollinger (Ilfracombe), pers. comms).

The red-finned blue-eye project has always been presented as an on-going story: the various chapters have included all aspects of the project to-date including experiments to try and control the invasive species eastern gambusia, the legislative issues surrounding working on endangered species, the success and failure of red-finned blue-eye relocation events and the effects of droughts or floods. It is notable that exactly the same information has been presented in peer-reviewed papers, though in a far different form (Fensham *et al.* 2011; Kerezsy & Fensham 2013). Dramatic and humorous events have peppered the popular literature and media stories, no doubt adding to their appeal (Bearup 2011; McLeish 2011a; Smith 2012), and this is the major difference between the scientific and other reportage. For better or worse, there is no place for such digression in peer-reviewed science. Last, Edgbaston – the property, its harsh and almost-lunar landscape – and the fish itself, have provided ideal visual accompaniment to the large body of written work that has been produced.

The science communication effort that has gone into Edgbaston and saving the red-finned blue-eye has been productive for the sponsoring organisation, and has elevated public knowledge of the species and its plight. Although it remains difficult to evaluate the degree to which this has occurred, enough subjective evidence exists to conclude that there is far more reason to communicate such projects to a wider audience than to refrain from doing so.

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In memory of Michael Wills from Edgbaston, 1966 – 2014.

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